O. Byrko, Master student
P. Melnychuk, D.E., Prof., research advisor
I. Melnychenko, lecturer, language advisor
Zhytomyr State Technological University

THE USE OF SUPERHARD MATERIALS IN MECHANICAL CUTTING

The main goal of modern engineering is manufacturing the highest quality products as quickly as possible with minimal capital investment, att he same time accompanied by a constant increase in the complexity of geometric forms and details, their accuracy, high demand son surfaces and their properties, efficiency of assembly products and their operating conditions.

To meet the requirements for the finished product of engineering industry we need to find completely new solutions and ideas fori mprovement and introduction of new production facilities:manufacturing equipment and tooling.

One of the best examples of finding new ideas and solutions and their practical application is the synthesis of superhard materials (SHM).

Diamond synthesis theory was first proposed by O.I.Leypunskym (1939),which is based on experimental data of reverse transformation of diamond to graphite, formulated conditions of the transition of graphite into diamond and calculated equilibrium curve graphite - diamond at high pressures. The synthesis of diamond from graphite at high pressures (more than 4.0 GPa) and temperatures (more than 1400K) carried out in the presence of metallic carbon solvents (Ni, Fe, Co, and others).

Cubic boron nitride is superhard material, which has no natural counterpart. First cubic boron nitride was synthesized in 1956 by "General Electric" at high pressure (over 4.0 GPa) and high temperature (over 1473K) from hexagonal modification of boron nitride in the presence of alkali and alkaline earth metals (lead, antimony, tin, etc.). Cubic boron nitride, manufactured by "General Electric" was named Borazon.

Tool industry produces synthetic superhard materials based on diamond and cubic boron nitride.

In general SHM can be divided into four groups:

1) Synthetic polycrystalline materials based on diamond: АСБ5, АСБ6, АСБР, АСПК1, АСПК2, АСПК3, АСПВ, АСФ, АКМ СКМ, carbonite, diamond, СВ20, СВС, СВБ, СВК, СВПК,

2) Synthetic materials based on polycrystalline boron nitride (SPNB): Composite 01 (Elbor-P), kompozyt02 (belbor), kompozyt09 (PTNB), kompozyt10 (heksanit-R).

3) Composite polycrystalline materials (KSTM): SVAB, PKNB AC, compact.

4) Two-layer composite materials (DSKM) based on diamond: WCT, AMC ATP Diamet, SVBN-1 SVBN-10 SVBN-20 sumydya-200 mehapaks, stratopaks, synpaks, kompaks, polyblok, seropaks-P syndyt, dyatypt.

Accumulated evidence suggests that the use of diamond tools is the most effective on finishing operations in the processing of parts of colored metals and alloys, and polymer composites. The tool can be used for turning discontinuous surfaces and the

milling cutter with single and many tines, however, the stability of the tool will be lower than the processing without effort. Treatment can be performed on a frame and passage.

Diamond milling is usually used for the treatment of colored metals and alloys, precious metals, plane and grooves with high demands for flatness. In this case allowance on fine finish is not more than 0,1-0,15mm.

Diamond cutting plates in the processing of polymer composites are also used successfully. The use of cutting plates with mechanical fastening allows increase the resistance in 15 ... 25 times over than with tool from firm alloys and in 2 ... 4 times - from Balas (CRS).

Experience shows that the use of the cutting tool with boron nitride each processed material meets the optimal tool material, that is different to other characteristics of grains cBN (modification, grain size, concentration),ties (material, grain size, physical and mechanical characteristics, etc.),receive mode, etc. For example, amborite is used for continuous and intermittent cutting hardened steel, solid cast iron, castings with hardness 60 HRC; sumiboron BN200 - with continuous and discontinuous cutting hardened and alloy steel and cast iron; composite 01 - at fair treatment of hardened steel and cast iron; composite 10 - with continuous and discontinuous cutting heat-treated steel, cast iron, hard alloys containing 15% Co, surfaced and sprayed coatings, machining steels with austenitic structure.;kiborit - with continuous and discontinuous cutting difficult-heat-treated steels and alloys, cast iron of any hardness, clad materials of martensitic class with high hardness; sprayed materials based FE, Ni, Co, compositions with the addition of hard alloys.

When using SHM in machining together with increase of productivity and quality of the finished product of engineering industry there are a number of issues and questions, which must be addressed for continuous improvement of the competitiveness of manufacturers and meet the growing needs of consumers.

These problems, which arise directly during machining, can be attributed question of wear, vibration, impact fastening methods of cutting plates. These factors affect the deterioration of conditions of cutting and respectively the results of mechanical machining.

To eliminate these factors or reduce their impact a variety of technical solutions are used.

For example to reduce wear of cutting plates with SHM coating is used. To eliminate vibrations comprehensive solutions to improve manufacturing equipment and tooling are essential, so that vibrations occur once in several levels of technological system. To improve vibration resistance in mechanical fastening of cutting plates damping substrate based on colored alloys are used.

The application of the above and the constant search for new solutions can increase the potential of SHM in mechanical machining.